



TFT LCD Approval Specification

MODEL NO.: N140B6 - L01

Customer : Lenovo International

Approved by : _____

Note :

核准時間	部門	審核	角色	投票
2009-10-09 15:44:04	NB 產品管理處	<div>楊 2009.10.09 竣傑</div>	Director	Accept

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**CHI MEI**
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Version	Date	Page (New)	Section	Description
Ver 3.0	Mar. 5,'09	All	All	Approval specification first issued.
Ver3.1	Aug. 31,'09	16	5.2	Update 5.4 EDID Code
		18	6	6. Converter specification
		21	7.2	7.2 power on/off sequence
		37	drawing	Add long tape on FPC
		13	5.1	Update Note(1) (2)
		19	6.2	6.2RECOMMENDED OPERATING RATINGS
		21	7.1	Add fresh rate 50/40Hz
		22	7.2	Update power on/off sequence
		24	8.2	Update optical spec
		39	13	Update drawing
Ver3.2	Sep.25,'09			

1 GENERAL DESCRIPTION

1.1 OVERVIEW

N140B6-L01 is a 14.0" TFT Liquid Crystal Display module with LED Backlight unit and 40 pins LVDS interface. This module supports 1366 x 768 HD mode and can display 262,144 colors. The optimum viewing angle is at 6 o'clock direction.

1.2 FEATURES

- Aspect ratio 16:9
- HD (1366 x 768 pixels) resolution
- 3.3V LVDS (Low Voltage Differential Signaling) interface with 1 pixel/clock
- Meet RoHS requirement
- LED Backlight

1.3 APPLICATION

- TFT LCD Notebook

1.4 GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Active Area	309.40 (H) x 173.95 (V) (14.0" diagonal)	mm	(1)
Bezel Opening Area	313.51 (H) x 177.35 (V)	mm	
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1366 x R.G.B. x 768	pixel	-
Pixel Pitch	0.2265 (H) x 0.2265 (V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	262,144	color	-
Transmissive Mode	Normally white	-	-
Surface Treatment	Hard coating (3H), Anti-glare type	-	-

1.5 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	323	323.5	324	mm	(1)
	Vertical(V)	191.5	192	192.5	mm	
	Depth(D)	-	4.9	5.2	mm	
Weight		-	340	355	g	

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

2 ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT

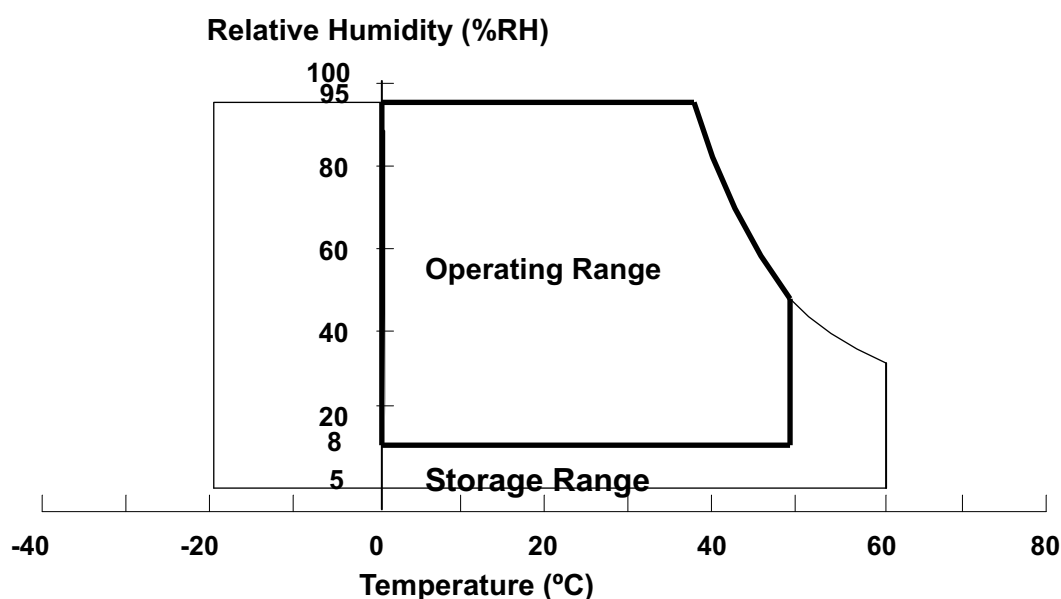
Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T _{ST}	-20	+60	°C	(1)
Operating Ambient Temperature	T _{OP}	0	+50	°C	(1), (2)
Shock (Non-Operating)	S _{NOP}	-	220/2	G	(3), (5)
Vibration (Non-Operating)	V _{NOP}	-	1.5	G	(4), (5)

Note (1) (a) 90 %RH Max. (Ta ≤ 40 °C).

(b) Wet-bulb temperature should be 39 °C Max. (Ta > 40 °C).

(c) No condensation.

Note (2) The temperature of panel display surface area should be 0 °C min. and 60 °C max.



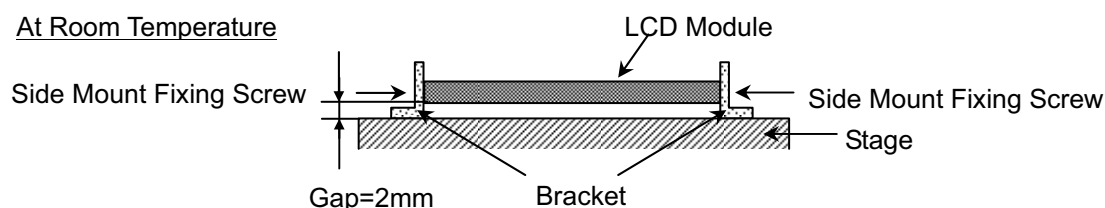
Note (3) 1 time for ± X, ± Y, ± Z. for Condition (220G / 2ms) is half Sine Wave,.

Note (4) 10 ~ 500 Hz, 30 min/cycle, 1 cycles for each X, Y, Z axis.

Note (5) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.

The fixing condition is shown as below:

At Room Temperature





2.2 ELECTRICAL ABSOLUTE RATINGS

2.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	V _{cc}	-0.3	+4.0	V	(1)
Logic Input Voltage	V _I	-0.3	V _{cc} +0.3	V	

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

2.2.2 BACKLIGHT UNIT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
LED Light Bar Power Supply Voltage	V _L	-40	28	V	(1), (2)
LED Light Bar Power Supply Current	I _L	0	125	mA	

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

Note (2) Specified values are for LED (Refer to Section 3.2 for further information).

3 ELECTRICAL CHARACTERISTICS

3.1 TFT LCD MODULE

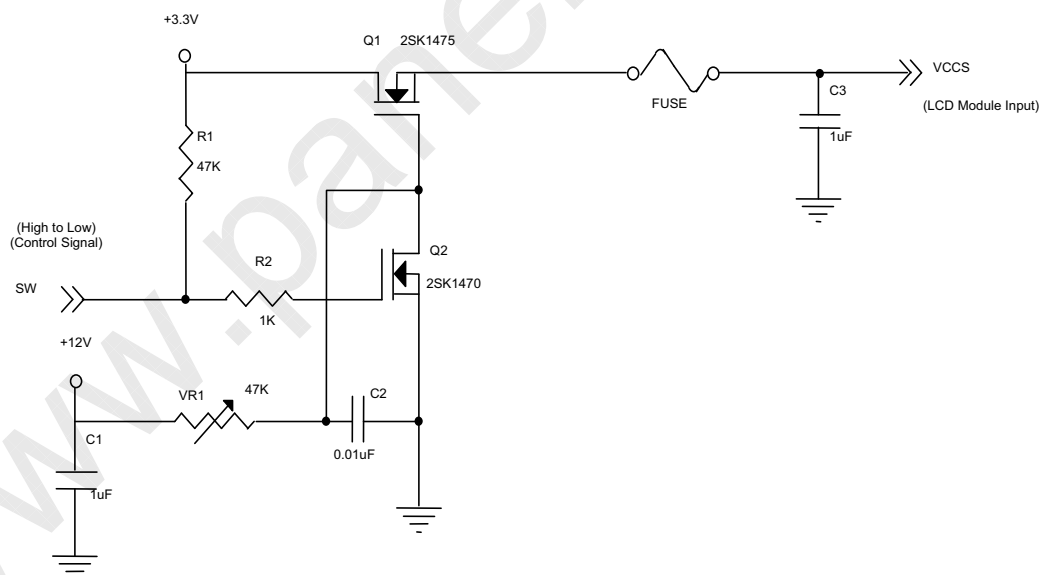
Ta = 25 ± 2 °C

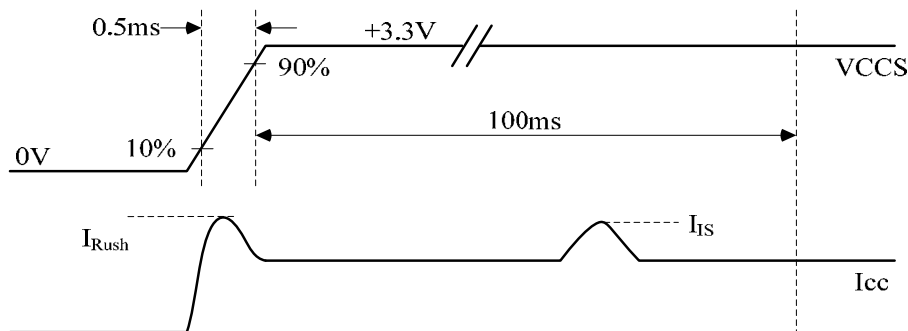
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		VCCS	3.0	3.3	3.6	V	-
Ripple Voltage		V _{RP}	-	50	-	mV	-
Rush Current		I _{RUSH}	-	-	1.5	A	(2)
Initial Stage Current		I _{IS}	-	-	1.0	A	(2)
Power Supply Current	White	I _{CC}	-	220	250	mA	(3)a
	Black		-	280	320	mA	(3)b
	Win XP		-	240	290	mA	
	1H2V		-	300	350	mA	
LVDS Differential Input High Threshold		V _{TH(LVDS)}	-	-	+100	mV	(4), V _{CM} =1.2V
LVDS Differential Input Low Threshold		V _{TL(LVDS)}	-100	-	-	mV	(4) V _{CM} =1.2V
LVDS Common Mode Voltage		V _{CM}	1.125	-	1.375	V	(4)
LVDS Differential Input Voltage		V _{ID}	100	-	600	mV	(4)
LVDS Terminating Resistor		R _T	-	100	-	Ohm	-
Power per EBL WG		PEBL	-	1.66	-	W	(5)

Note (1) The ambient temperature is Ta = 25 ± 2 °C.

Note (2) I_{RUSH}: the maximum current when VCCS is risingI_{IS}: the maximum current of the first 100ms after power-on

Measurement Conditions: Shown as the following figure. Test pattern: black.



VCCS rising time is 0.5ms

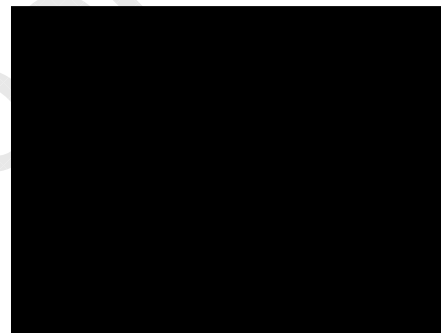
Note (3) The specified power supply current is under the conditions at VCCS = 3.3 V, $T_a = 25 \pm 2^\circ\text{C}$, DC Current and $f_v = 60\text{ Hz}$, whereas a power dissipation check pattern below is displayed.

a. White Pattern



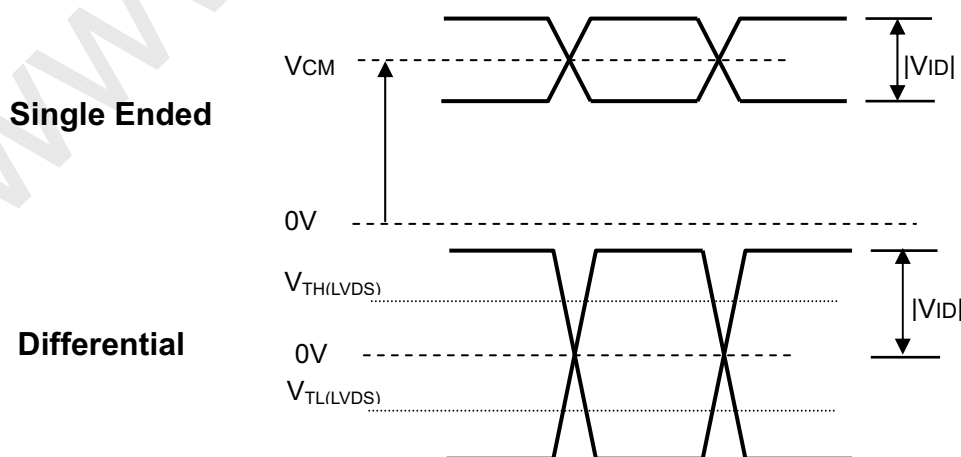
Active Area

b. Black Pattern



Active Area

Note (4) The parameters of LVDS signals are defined as the following figures.





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Note (5) The specified power are the sum of LCD panel electronics input power and the converter input power. Test conditions are as follows.

(a) VCCS = 3.3 V, $T_a = 25 \pm 2$ °C, $f_v = 60$ Hz,

(b) The pattern used is a black and white 32 x 36 checkerboard, slide #100 from the VESA file
"Flat Panel Display Monitor Setup Patterns", FPDMSU.ppt.

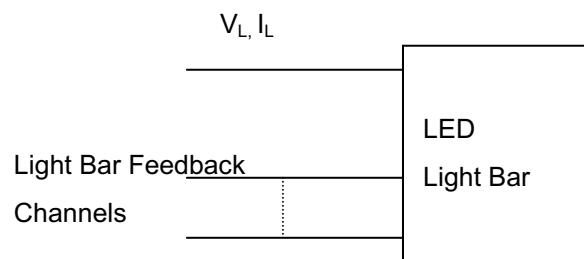
(c) Luminance: 60 nits.

3.2 BACKLIGHT UNIT

 $T_a = 25 \pm 2 \text{ }^{\circ}\text{C}$

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
LED Light Bar input Voltage	V_L	24	25.6	28	V_{dc}	(1), (2) Duty 100%
LED Light Bar input Current	I_L	95	100	105	mA	
Power Consumption	P_L	2.28	2.56	2.94	W	(3), $I_L = 100\text{mA}$ Duty=100%
LED Life Time	L_{BL}	15,000	-	-	Hrs	(4)

Note (1) LED light bar configuration is shown as below:



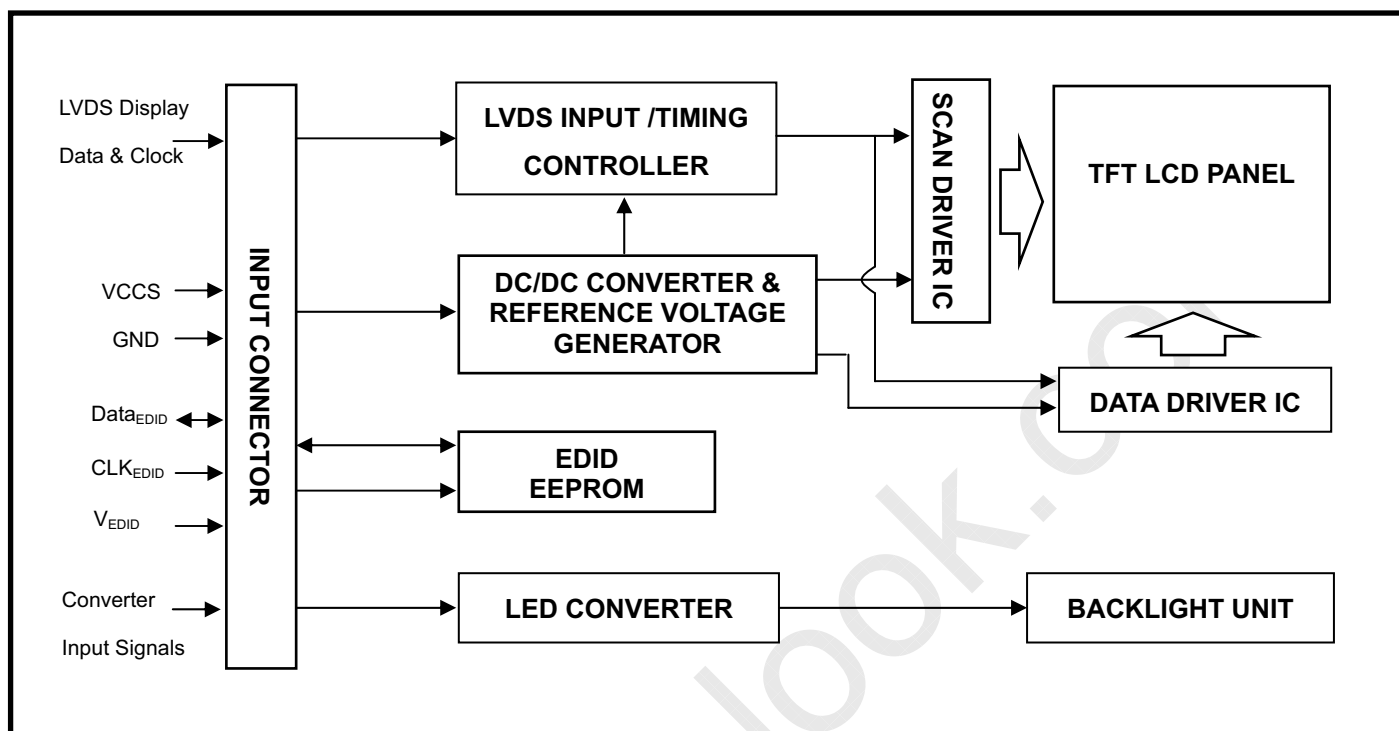
Note (2) For better LED light bar driving quality, it is recommended to utilize the adaptive boost converter with current balancing function to drive LED light-bar.

Note (3) $P_L = I_L \times V_L$

Note (4) The lifetime of LED is defined as the time when it continues to operate under the conditions at $T_a = 25 \pm 2 \text{ }^{\circ}\text{C}$ and $I_L = 20 \text{ mA}$ (Per EA) until the brightness becomes $\leq 50\%$ of its original value.

4 BLOCK DIAGRAM

4.1 TFT LCD MODULE





5 INPUT TERMINAL PIN ASSIGNMENT

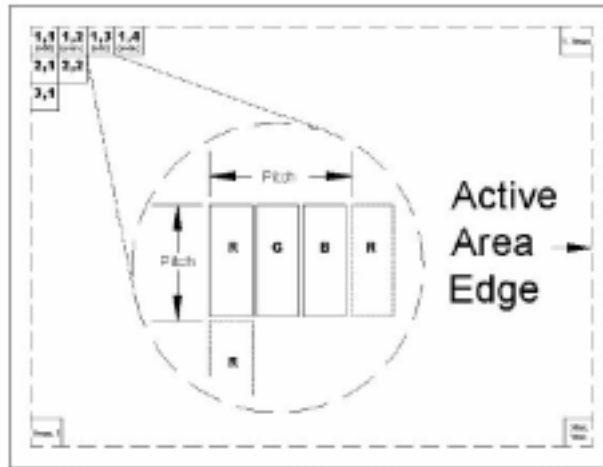
5.1 TFT LCD MODULE

Pin	Symbol	Description	Polarity	Remark
1	Reserve	Non-Connection use by CMO		
2	VCCS	Power Supply +3.3 V		
3	VCCS	Power Supply +3.3 V		
4	EE_VDD	DDC +3.3 V		
5	NC	No Connection		
6	EE_SC	DDC Clock		
7	EE_SD	DDC Data		
8	Rx0-	LVDS Differential Data Input	Negative	R0~R5,G0-
9	Rx0+	LVDS Differential Data Input	Positive	
10	VSS	Ground		
11	Rx1-	LVDS Differential Data Input	Negative	G1~G5,B0,B1
12	Rx1+	LVDS Differential Data Input	Positive	
13	VSS	Ground		
14	Rx2-	LVDS Differential Data Input	Negative	- B2~B5,Hsync,Vsync,DE
15	Rx2+	LVDS Differential Data Input	Positive	
16	VSS	Ground		
17	RXC-	LVDS Clock Data Input	Negative	LVDS Level Clock
18	RXC+	LVDS Clock Data Input	Positive	
19	VSS	Ground	-	
20	NC	No Connection	-	
21	NC	No Connection		
22	VSS	Ground		
23	NC	No Connection		
24	NC	No Connection		
25	VSS	Ground		
26	NC	No Connection		
27	NC	No Connection		
28	VSS	Ground		
29	NC	No Connection		
30	NC	No Connection		
31	LED_GND	Ground_LED		
32	LED_GND	Ground_LED		
33	LED_GND	Ground_LED		
34	Reserve	Non-Connection use by CMO		
35	LED_PWM	PWM Control Signal of LED Converter		
36	LED_EN	Enable Control Signal of LED Converter		
37	NC	No Connection		
38	LED_VCCS	LED Power		LED Power Input
39	LED_VCCS	LED Power		
40	LED_VCCS	LED Power		

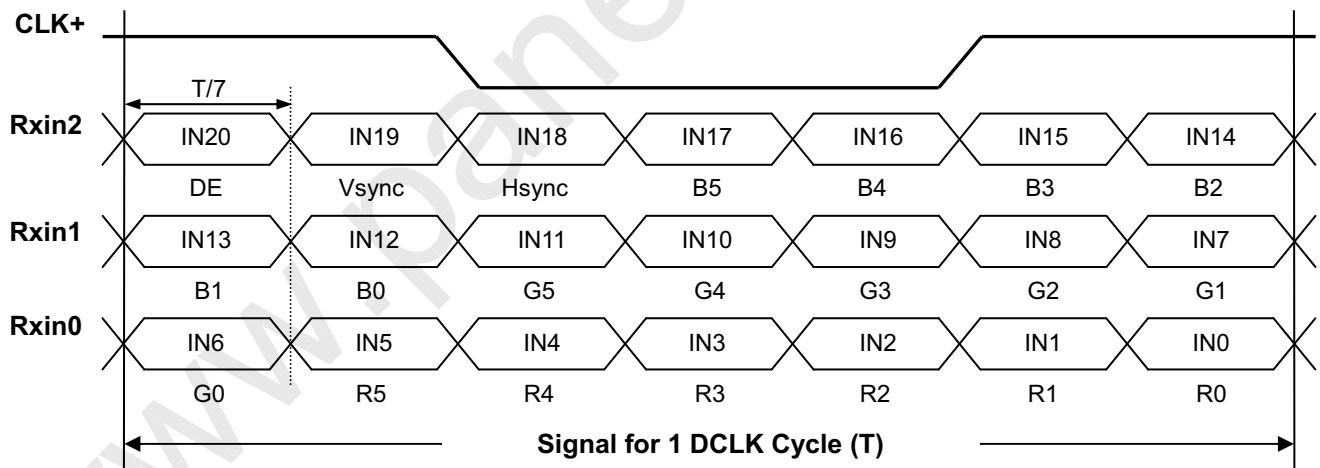
Note (1) Connector Part No.: I-PEX 20455-040E-12

Note (2) User's connector Part No.: I-PEX 20453-040T-11

Note (3) The first pixel is odd as shown in the following figure.



5.2 TIMING DIAGRAM OF LVDS INPUT SIGNAL



5.3 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 6-bit gray scale data input for the color. The higher the binary input the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																	
		Red						Green						Blue					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of Red	Red(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
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	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(61)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Red(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	
Gray Scale Of Green	Green(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
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	Green(61)	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	Green(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	
Gray Scale Of Blue	Blue(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
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	Blue(61)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	

Note (1) 0: Low Level Voltage, 1: High Level Voltage

5.4 EDID DATA STRUCTURE

The EDID (Extended Display Identification Data) data formats are to support displays as defined in the VESA Plug & Display and FPD1 standards.

Byte # (decimal)	Byte # (hex)	Field Name and Comments	Value (hex)	Value (binary)
0	0	Header	00	00000000
1	1	Header	FF	11111111
2	2	Header	FF	11111111
3	3	Header	FF	11111111
4	4	Header	FF	11111111
5	5	Header	FF	11111111
6	6	Header	FF	11111111
7	7	Header	00	00000000
8	8	ID system manufacturer name (LSB)	30	00110000
9	9	ID system manufacturer name (MSB)	AE	10101110
10	0A	ID system Product Code (LSB)	A0	10100000
11	0B	ID system Product Code (MSB)	40	01000000
12	0C	ID Serial Number (32-bit serial number)	00	00000000
13	0D	ID Serial Number (32-bit serial number)	00	00000000
14	0E	ID Serial Number (32-bit serial number)	00	00000000
15	0F	ID Serial Number (32-bit serial number)	00	00000000
16	10	Week of Manufacture	44	01000100
17	11	Year of Manufacture	12	00010010
18	12	EDID Structure version	01	00000001
19	13	EDID Revision	03	00000011
20	14	Video Input Definition	80	10000000
21	15	Active Area Horizontal Image Size (cm) - 30.94 cm	1F	00011111
22	16	Active Area Vertical Image Size (cm) - 17.395cm	11	00010001
23	17	Display gamma (gamma x 100)-100, (Gamma 2.2)	78	01111000
24	18	Feature support	EA	11101010
25	19	Rx1, Rx0, Ry1, Ry0, Gx1, Gx0, Gy1, Gy0	0D	00001101
26	1A	Bx1, Bx0, By1, By0, Wx1, Wx0, Wy1, Wy0	35	00110101
27	1B	Rx=0.617	9E	10011110
28	1C	Ry=0.344	58	01011000
29	1D	Gx=0.327	53	01010011
30	1E	Gy=0.587	96	10010110
31	1F	Bx=0.16	29	00101001
32	20	By=0.085	15	00010101
33	21	Wx=0.313	50	01010000
34	22	Wy=0.329	54	01010100
35	23	Established Timing 1	00	00000000
36	24	Established Timing 2	00	00000000
37	25	Manufacturer's Timings	00	00000000
38	26	Standard Timing Identification #1	01	00000001
39	27	Standard Timing Identification #1	01	00000001
40	28	Standard Timing Identification #2	01	00000001



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41	29	Standard Timing Identification #2	01	00000001
42	2A	Standard Timing Identification #3	01	00000001
43	2B	Standard Timing Identification #3	01	00000001
44	2C	Standard Timing Identification #4	01	00000001
45	2D	Standard Timing Identification #4	01	00000001
46	2E	Standard Timing Identification #5	01	00000001
47	2F	Standard Timing Identification #5	01	00000001
48	30	Standard Timing Identification #6	01	00000001
49	31	Standard Timing Identification #6	01	00000001
50	32	Standard Timing Identification #7	01	00000001
51	33	Standard Timing Identification #7	01	00000001
52	34	Standard Timing Identification #8	01	00000001
53	35	Standard Timing Identification #8	01	00000001
54	36	Detailed timing description # 1 60Hz Timing Pixel clock ("72.1MHz", According to VESA CVT Rev1.1)	2B	00101011
55	37	# 1 Pixel Clock (MSB) / (example: Pixel Clock / 10000)	1C	00011100
56	38	# 1 Horizontal Active ("1366")	56	01010110
57	39	# 1 Horizontal Blanking ("143")	8F	10001111
58	3A	# 1Horizontal Active : Horizontal Blanking ("1366 : 143")	50	01010000
59	3B	# 1Vertical Active ("768")	00	00000000
60	3C	# 1Vertical Blanking ("28")	1C	00011100
61	3D	# 1Vertical Active : Vertical Blanking ("768 :28")	30	00110000
62	3E	# 1 Horizontal Sync. Offset ("23")	17	00010111
63	3F	# 1 Horizontal Sync Pulse Width ("48")	30	00110000
64	40	# 1 Vertical Sync Offset : Sync Width ("3 : 9")	39	00111001
65	41	# 1 Horizontal Vertical Sync Offset/Width upper 2bits = 0	00	00000000
66	42	# 1 Horizontal Image Size (309 mm)	35	00110101
67	43	# 1 Vertical Image Size (174 mm)	AE	10101110
68	44	# 1 Horizontal & Vertical Image Size (309:174)	10	00010000
69	45	# 1 Horizontal Border = 0	00	00000000
70	46	# 1 Vertical Border = 0	00	00000000
71	47	# 1 Flags, Non-interlaced,Normal display,no stereo,Digital separate sync,H/V pol negatives	18	00011000
72	48	Detailed timing description # 2 Slow Refresh Rate Timing Pixel clock ("62.63MHz", According to VESA CVT Rev1.1) Refresh Rate:50Hz	77	01110111
73	49	# 2 Slow Refresh Rate Pixel Clock (MSB) / (example: Pixel Clock / 10000)	18	00011000
74	4A	# 2 Horizontal Active ("1366")	56	01010110
75	4B	# 2 Horizontal Blanking ("194")	C2	11000010
76	4C	# 2 Horizontal Active : Horizontal Blanking ("1366 : 194")	50	01010000
77	4D	# 2 Vertical Active ("768")	00	00000000
78	4E	# 2 Vertical Blanking ("38")	26	00100110
79	4F	# 2 Vertical Active : Vertical Blanking ("768 :38")	30	00110000
80	50	# 2 Horizontal Sync. Offset ("31")	1F	00011111
81	51	# 2 Horizontal Sync Pulse Width ("65")	41	01000001
82	52	# 2 Vertical Sync Offset : Sync Width ("4 : 12")	4C	01001100
83	53	# 2 Horizontal Vertical Sync Offset/Width upper 2bits = 0	00	00000000
84	54	# 2 Horizontal Image Size (309 mm)	35	00110101
85	55	# 2 Vertical Image Size (174 mm)	AE	10101110



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86	56	# 2 Horizontal & Vertical Image Size (309:174)	10	00010000
87	57	# 2 Horizontal Border = 0	00	00000000
88	58	# 2 Vertical Border = 0	00	00000000
89	59	# 2 Flags, Non-interlaced, Normal display, no stereo, Digital separate sync, H/V pol negatives	18	00011000
90	5A	Flag	00	00000000
91	5B	Flag	00	00000000
92	5C	Flag	00	00000000
93	5D	Data Type Tag	0F	00001111
94	5E	Flag	00	00000000
95	5F	Middle Refresh Rate #1 (Horizontal active pixels / 8) - 31	8C	10001100
96	60	Middle Refresh Rate #1 Image Aspect ratio (16 : 9)	09	00001001
97	61	Middle Refresh Rate #1 Refresh Rate = 50Hz	32	00110010
98	62	Low Refresh Rate #2 (Horizontal active pixels / 8) - 31	8C	10001100
99	63	Low Refresh Rate #2 Image Aspect ratio (16 : 9)	09	00001001
100	64	Low Refresh Rate #2 Refresh Rate = 40Hz	28	00101000
101	65	Brightness (220 / 10 nit)	16	00010110
102	66	Feature flag	09	00001001
103	67	Reserved	00	00000000
104	68	LCD Supplier manufacturer code	0D	00001101
105	69	LCD Supplier manufacturer code, (Hex, LSB first)	AF	10101111
106	6A	LCD Supplier Product code	50	01010000
107	6B	LCD Supplier Product code (Hex, LSB first)	14	00010100
108	6C	Flag	00	00000000
109	6D	Flag	00	00000000
110	6E	Flag	00	00000000
111	6F	Data Type Tag	FE	11111110
112	70	Flag	00	00000000
113	71	Model Name (N140B6-L01, 1st character, "N")	4E	01001110
114	72	Model Name (N140B6-L01, 2nd character, "1")	31	00110001
115	73	Model Name (N140B6-L01, 3rd character, "4")	34	00110100
116	74	Model Name (N140B6-L01, 4th character, "0")	30	00110000
117	75	Model Name (N140B6-L01, 5th character, "B")	42	01000010
118	76	Model Name (N140B6-L01, 6th character, "6")	36	00110110
119	77	Model Name (N140B6-L01, 7th character, "-")	2D	00101101
120	78	Model Name (N140B6-L01, 8th character, "L")	4C	01001100
121	79	Model Name (N140B6-L01, 9th character, "0")	30	00110000
122	7A	Model Name (N140B6-L01, 10th character, "1")	31	00110001
123	7B	Model Name (If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h)	0A	00001010
124	7C	Model Name (If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h)	20	00100000
125	7D	Model Name (If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h)	20	00100000
126	7E	Extension flag	00	00000000
127	7F	Checksum	23	00100011

6 CONVERTER SPECIFICATION

6.1 ABSOLUTE MAXIMUM RATINGS

Symbol	Ratings
LED_VCCS	-0.3V~25V
LED_PWM	-0.3V~5.5V
LED_EN	-0.3V~5.5V

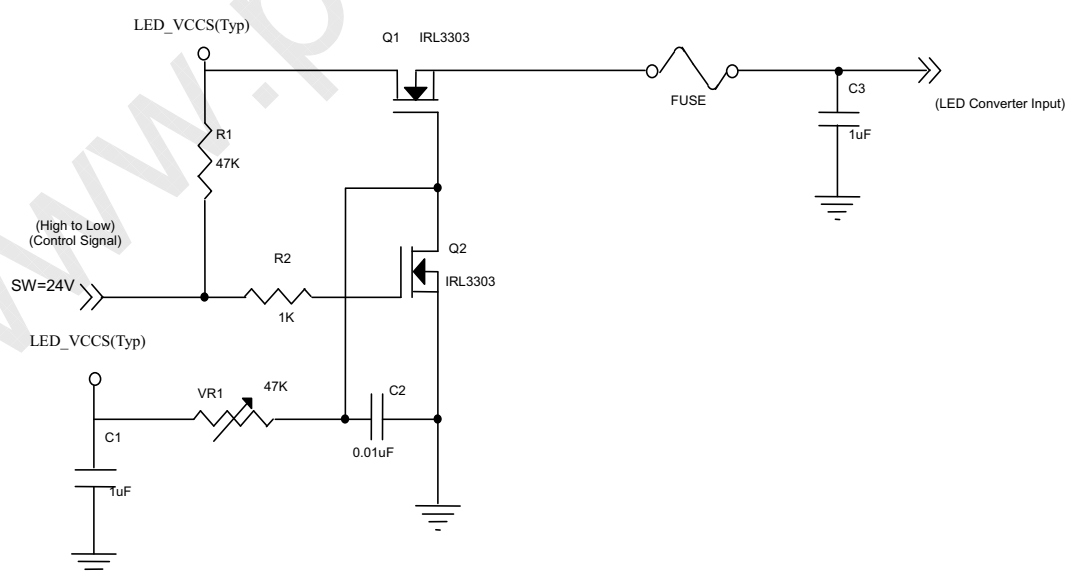
6.2 RECOMMENDED OPERATING RATINGS

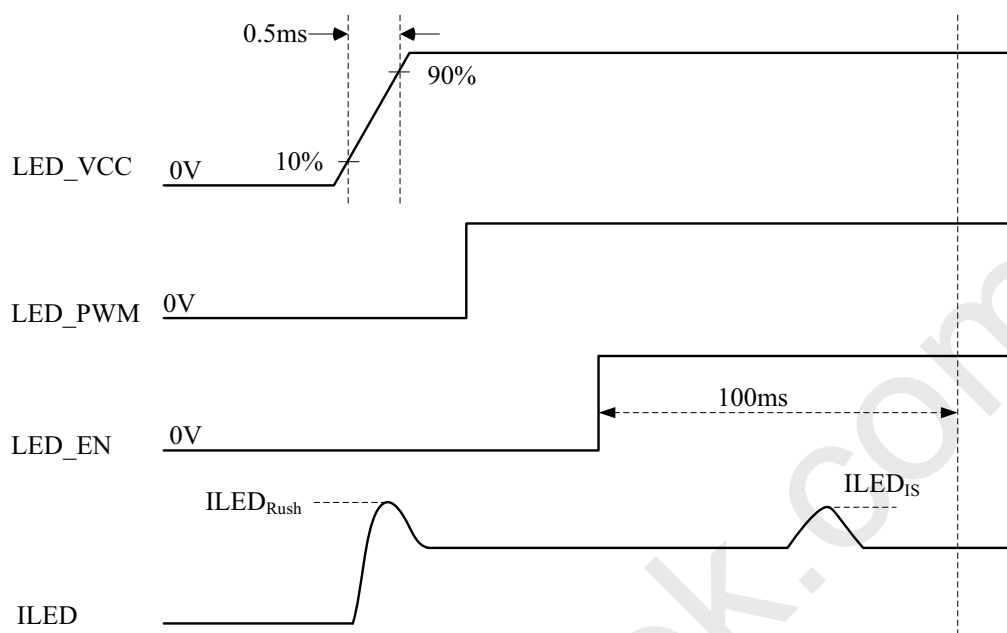
Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Converter Input power supply voltage	LED_Vccs	6	12.0	21.0	V	-
Converter Rush Current	I _{LED_RUSH}	-	-	1.5	A	(1)
Converter Initial Stage Current	I _{LED_IS}	-	-	1.5	A	(1)
EN Control Level	Backlight On	2.0	-	5.0	V	-
	Backlight Off	0	-	0.8	V	-
PWM Control Level	PWM High Level	2.0	-	5.0	V	-
	PWM Low Level	0	-	0.15	V	-
PWM Control Duty Ratio		10	-	100	%	-
		1	-	100	%	(2)
PWM Control Permissive Ripple Voltage	V _{PWM_pp}	-	-	100	mV	-
PWM Control Frequency	f _{PWM}	100	-	2K	Hz	(3)
LED Power Current	LED_VCCS =Min.	422	502	613	mA	(4)
	LED_VCCS =Typ.	211	251	306	mA	(4)
	LED_VCCS =Max.	121	143	175	mA	(4)

Note (1) I_{LED_RUSH}: the maximum current when LED_VCCS is rising,

I_{LED_IS}: the maximum current of the first 100ms after power-on,

Measurement Conditions: Shown as the following figure. LED_VCCS = Typ, Ta = 25 ± 2 °C, f_{PWM} = 200 Hz, Duty=100%.



VLED rising time is 0.5ms

Note (2) If the PWM control duty ratio is less than 10%, there is some possibility that acoustic noise or backlight flash can be found. And it is also difficult to control the brightness linearity.

Note (3) If PWM control frequency is applied in the range less than 1KHz, the “waterfall” phenomenon on the screen may be found. To avoid the issue, it's a suggestion that PWM control frequency should follow the criterion as below.

PWM control frequency f_{PWM} should be in the range

$$(N + 0.33) * f \leq f_{PWM} \leq (N + 0.66) * f$$

N : Integer ($N \geq 3$)

f : Frame rate

Note (4) The specified LED power supply current is under the conditions at “LED_VCCS = Min., Typ., Max.”,
 $T_a = 25 \pm 2^\circ\text{C}$, $f_{PWM} = 200\text{ Hz}$, Duty=100%.

7 INTERFACE TIMING

7.1 INPUT SIGNAL TIMING SPECIFICATIONS

The input signal timing specifications are shown as the following table and timing diagram.

Refresh rate 60Hz

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	1/Tc	57	75.44	79	MHz	
DE	Vertical Total Time	TV	769	806	1200	TH	
	Vertical Active Display Period	TVD	768	768	768	TH	
	Vertical Active Blanking Period	TVB	TV-TVD	38	TV-TVD	TH	
	Horizontal Total Time	TH	1370	1560	1960	Tc	
	Horizontal Active Display Period	THD	1366	1366	1366	Tc	
	Horizontal Active Blanking Period	THB	TH-THD	194	TH-THD	Tc	

Refresh rate 50Hz

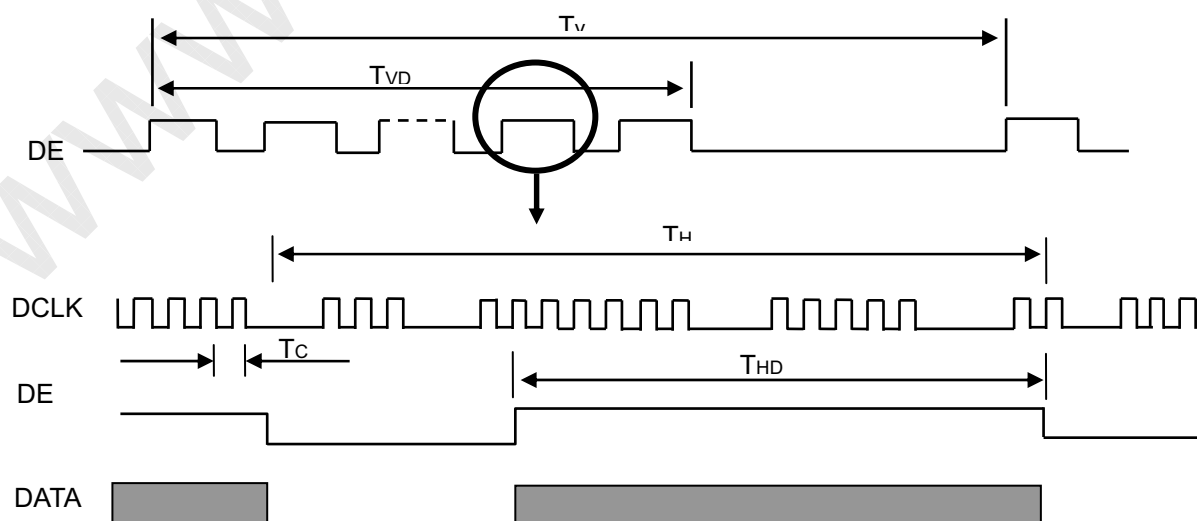
Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	1/Tc	48	62.87	65	MHz	
DE	Vertical Total Time	TV	769	806	1200	TH	
	Vertical Active Display Period	TVD	768	768	768	TH	
	Vertical Active Blanking Period	TVB	TV-TVD	38	TV-TVD	TH	
	Horizontal Total Time	TH	1370	1560	1960	Tc	
	Horizontal Active Display Period	THD	1366	1366	1366	Tc	
	Horizontal Active Blanking Period	THB	TH-THD	194	TH-THD	Tc	

Refresh rate 40Hz

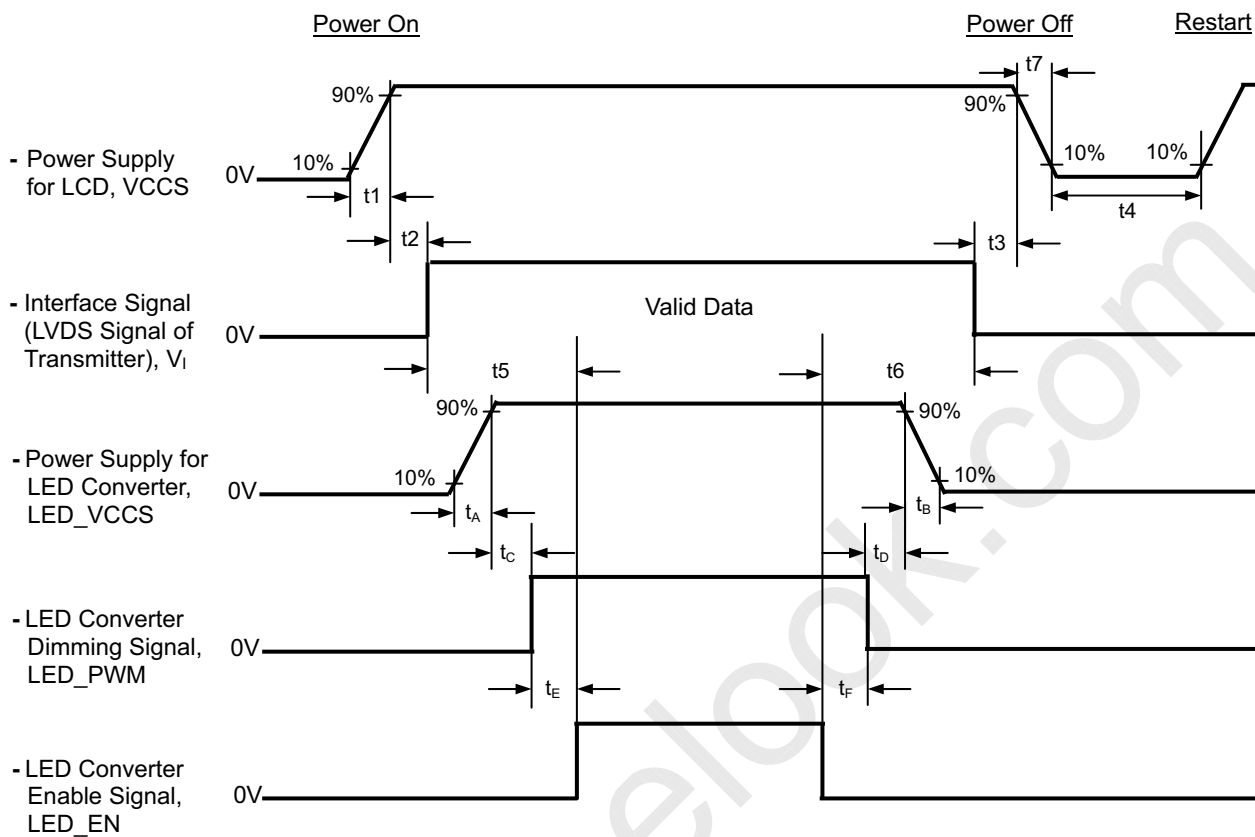
Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	1/Tc	38	50.29	52	MHz	
DE	Vertical Total Time	TV	769	806	1200	TH	
	Vertical Active Display Period	TVD	768	768	768	TH	
	Vertical Active Blanking Period	TVB	TV-TVD	38	TV-TVD	TH	
	Horizontal Total Time	TH	1370	1560	1960	Tc	
	Horizontal Active Display Period	THD	1366	1366	1366	Tc	
	Horizontal Active Blanking Period	THB	TH-THD	194	TH-THD	Tc	

Note (1) Because this module is operated by DE only mode, Hsync and Vsync are ignored

INPUT SIGNAL TIMING DIAGRAM



7.2 POWER ON/OFF SEQUENCE



Timing Specifications:

$$0.5 \leq t_1 \leq 10 \text{ ms}$$

$$0 \leq t_2 \leq 50 \text{ ms}$$

$$0 \leq t_3$$

$$t_4 \geq 150 \text{ ms}$$

$$t_5 \geq 200 \text{ ms}$$

$$t_6 \geq 0 \text{ ms}$$

$$0 \leq t_7 \leq 10 \text{ ms}$$

$$0.5 \leq t_A \leq 10 \text{ ms}$$

$$t_B > 0 \text{ ms}$$

$$t_C \geq 0 \text{ ms}$$

$$t_D \geq 0 \text{ ms}$$

$$t_E \geq 0 \text{ ms}$$

$$t_F \geq 0 \text{ ms}$$



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Note (1) Please follow the power on/off sequence described above. Otherwise, the LCD module might be damaged.

Note (2) Please avoid floating state of interface signal at invalid period. When the interface signal is invalid, be sure to pull down the power supply of LCD VCCS to 0 V.

Note (3) The backlight must be turned on after the power supply for the logic and the interface signal is valid. The backlight must be turned off before the power supply for the logic and the interface signal is invalid.

Note (4) Please follow the LED converter power sequence as above. If the customer could not follow, it might cause backlight flash issue during display ON/OFF or damage the LED backlight controller

8 OPTICAL CHARACTERISTICS

8.1 TEST CONDITIONS

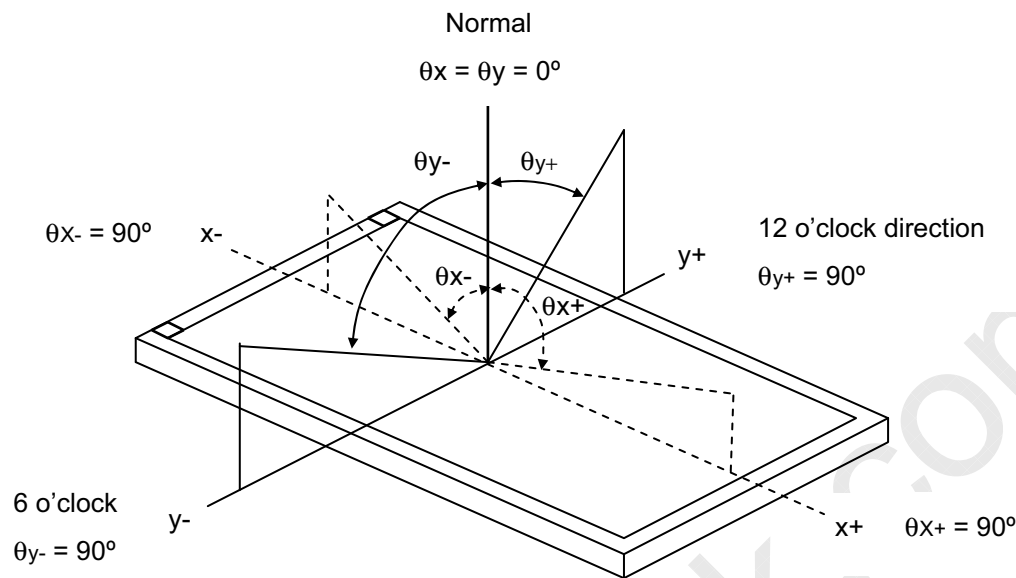
Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V _{CC}	3.3	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
LED Light Bar Input Current	I _L	100	mA

The measurement methods of optical characteristics are shown in Section 8.2. The following items should be measured under the test conditions described in Section 8.1 and stable environment shown in Note (5).

8.2 OPTICAL SPECIFICATIONS

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	$\theta_x=0^\circ, \theta_y=0^\circ$ Viewing Normal Angle	300	500	-	-	(2), (5)
Response Time		T _R		-	3	8	ms	(3)
		T _F		-	7	12	ms	
Luminance of White (5P)		L _{AVE}		190	220	-	cd/m ²	(4), (5)
White Variation (5P)		δW		80	--		%	(5), (6)
White Variation (13P)		δW		60	--		%	(5), (6)
Color Chromaticity	Red	R _x		Typ.- 0.03	0.617	Typ.+ 0.03	-	(1), (5)
		R _y			0.344		-	
	Green	G _x			0.327		-	
		G _y			0.587		-	
	Blue	B _x			0.160		-	
		B _y			0.085		-	
	White	W _x			0.313		-	
		W _y			0.329		-	
Viewing Angle	Horizontal	θ_{x+}	CR≥10	40	45	-	Deg.	(1), (5)
		θ_{x-}		40	45	-		
	Vertical	θ_{y+}		15	20	-		
		θ_{y-}		40	45	-		

Note (1) Definition of Viewing Angle (θ_x , θ_y):



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{63} / L_0$$

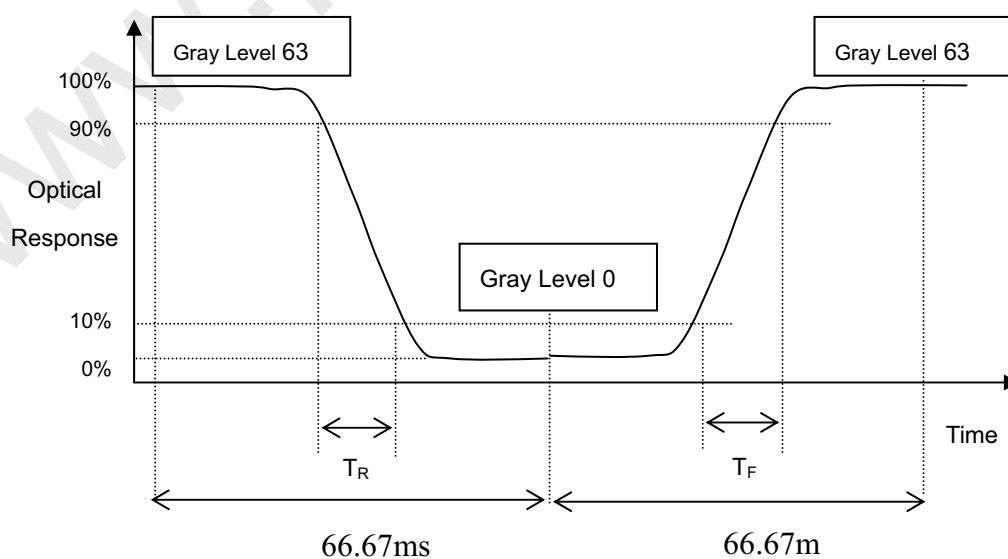
L63: Luminance of gray level 63

L 0: Luminance of gray level 0

$$\text{CR} = \text{CR} (5)$$

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (6).

Note (3) Definition of Response Time (T_R , T_F):



Note (4) Definition of Average Luminance of White (L_{AVE}):

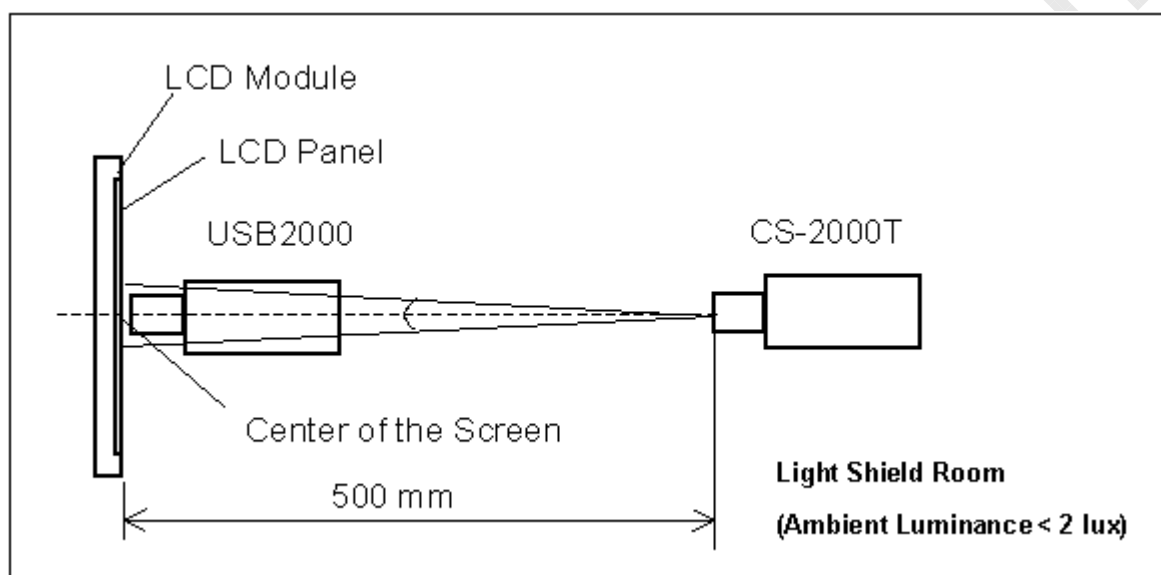
Measure the luminance of gray level 63 at 5 points

$$L_{AVE} = [L(1) + L(2) + L(3) + L(4) + L(5)] / 5$$

$L(x)$ is corresponding to the luminance of the point X at Figure in Note (6).

Note (5) Measurement Setup:

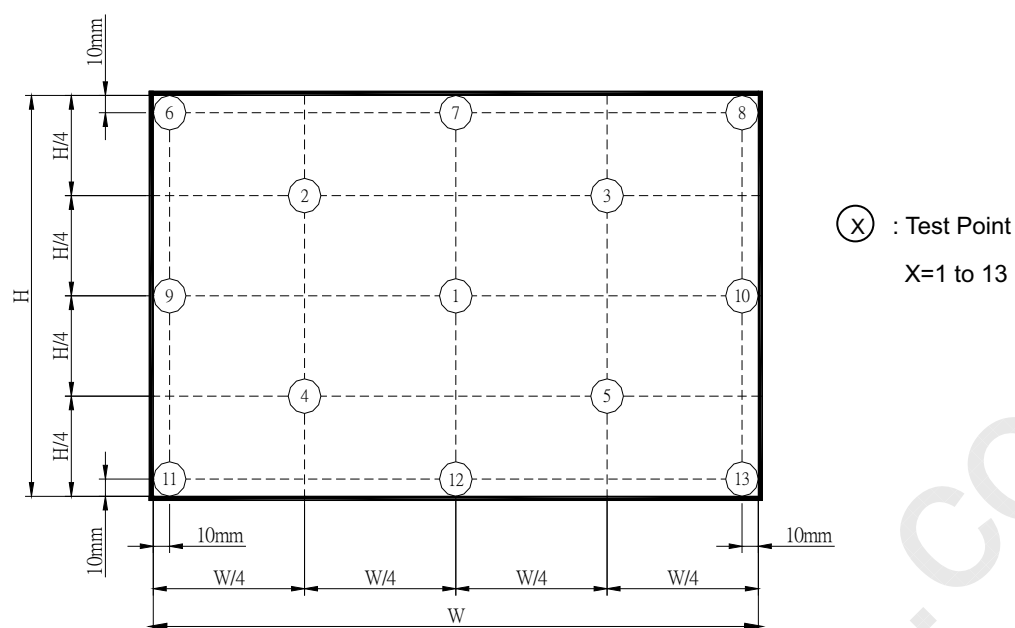
The LCD module should be stabilized at given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.


Note (6) Definition of White Variation (δW):

Measure the luminance of gray level 63 at 5 points

$$\delta W_{5p} = \{ \text{Minimum} [L(1) + L(2) + L(3) + L(4) + L(5)] / \text{Maximum} [L(1) + L(2) + L(3) + L(4) + L(5)] \} * 100\%$$

$$\delta W_{13p} = \{ \text{Minimum} [L(1) + L(2) + L(3) + L(4) + L(5) + L(6) + L(7) + L(8) + L(9) + L(10) + L(11) + L(12) + L(13) + L(14) + L(15)] / \text{Maximum} [L(1) + L(2) + L(3) + L(4) + L(5) + L(6) + L(7) + L(8) + L(9) + L(10) + L(11) + L(12) + L(13) + L(14) + L(15)] \} * 100\%$$



9 PRECAUTIONS

9.1 HANDLING PRECAUTIONS

- (1) The module should be assembled into the system firmly by using every mounting hole. Be careful not to twist or bend the module.
- (2) While assembling or installing modules, it can only be in the clean area. The dust and oil may cause electrical short or damage the polarizer.
- (3) Use fingerstalls or soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (4) Do not press or scratch the surface harder than a HB pencil lead on the panel because the polarizer is very soft and easily scratched.
- (5) If the surface of the polarizer is dirty, please clean it by some absorbent cotton or soft cloth. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanently damage the polarizer due to chemical reaction.
- (6) Wipe off water droplets or oil immediately. Staining and discoloration may occur if they left on panel for a long time.
- (7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contacting with hands, legs or clothes, it must be washed away thoroughly with soap.
- (8) Protect the module from static electricity, it may cause damage to the C-MOS Gate Array IC.
- (9) Do not disassemble the module. Do not pull or fold the lamp wire.
- (10) Pins of I/F connector should not be touched directly with bare hands.

9.2 STORAGE PRECAUTIONS

- (1) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.
- (2) It is dangerous that moisture come into or contacted the LCD module, because the moisture may damage LCD module when it is operating.
- (3) It may reduce the display quality if the ambient temperature is lower than 10 °C. For example, the response time will become slowly, and the starting voltage of lamp will be higher than the room temperature.

9.3 OPERATION PRECAUTIONS

- (1) Do not pull the I/F connector in or out while the module is operating.
- (2) Always follow the correct power on/off sequence when LCD module is connecting and operating. This can prevent the CMOS LSI chips from damage during latch-up.
- (3) The startup voltage of Backlight is approximately 1000 Volts. It may cause electrical shock while assembling with converter. Do not disassemble the module or insert anything into the Backlight unit.

9.4 OTHER PRECAUTIONS

- (1) When fixed patterns are displayed for a long time, remnant image is likely to occur.

10 PACKING

10.1 CARTON

Box Dimensions : 435(L)*350(W)*320(H)
Weight: Approx. 9.84kg(20 module .per. 1 box)

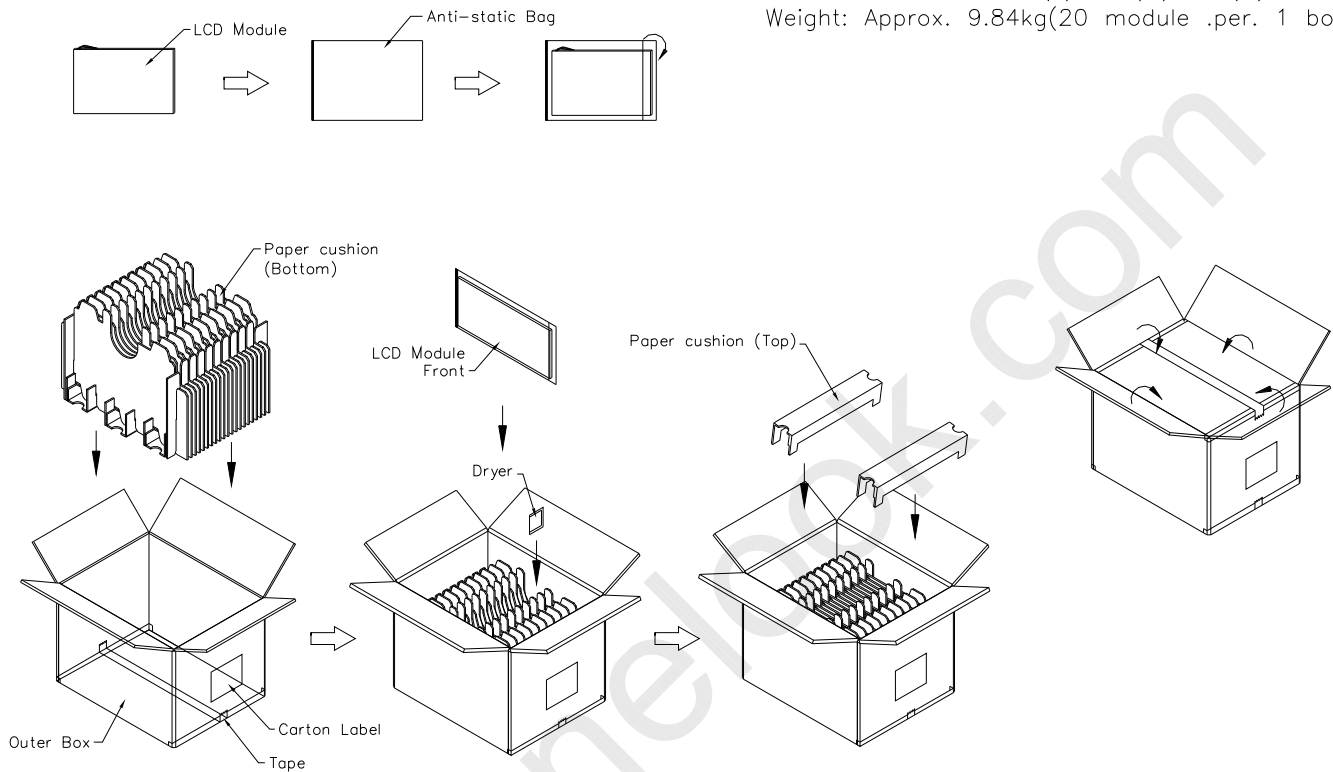
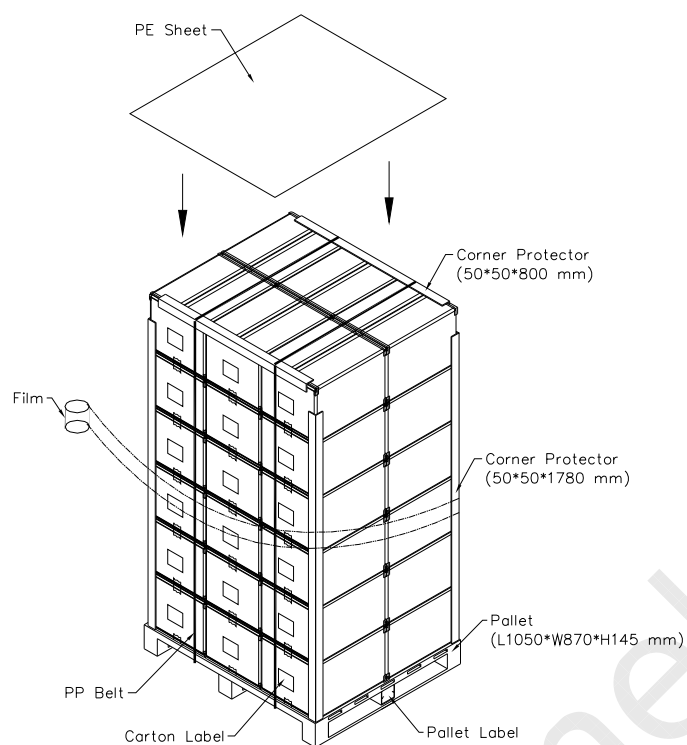


Figure. 10-1 Packing method

10.2 PALLET

Sea & Land Transportation



Air Transportation

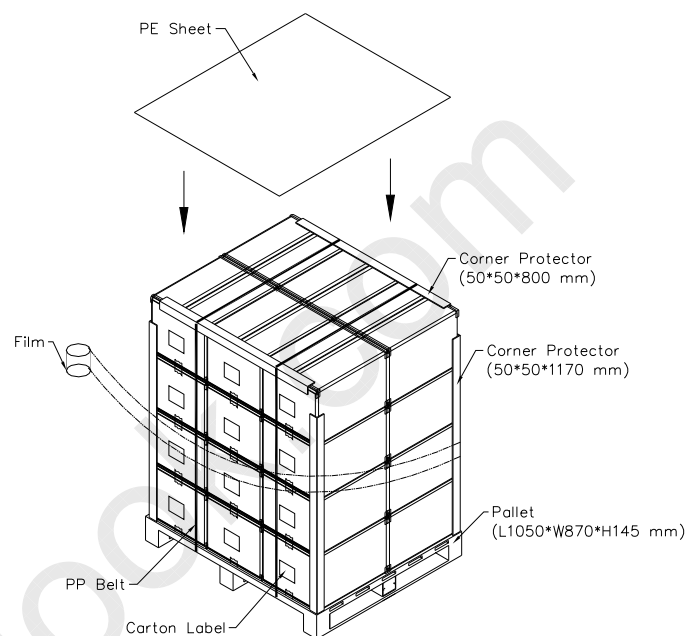


Figure. 10-2 Packing method

11 DEFINITION OF LABELS

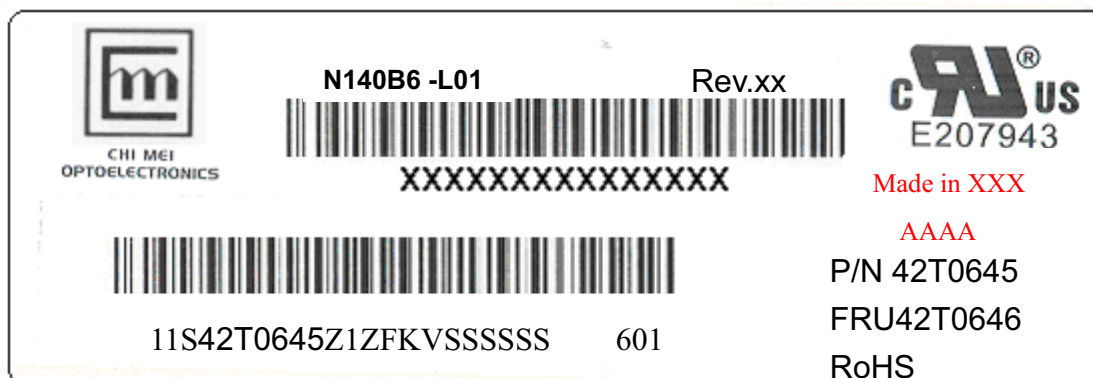
11.1 CMO MODULE LABEL



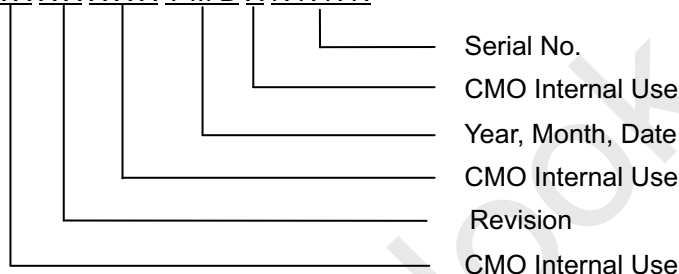
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The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.



- (a) Model Name: N140B6 - L01
 (b) Revision: Rev. XX, for example: A1, ..., C1, C2 ...etc.
 (c) Serial ID: X X X X X X Y M D X N N N N



- (d) Production Location: MADE IN XXXX. XXXX stands for production location.
 (e) UL logo: "AAAA" especially stands for panel manufactured by CMO China satisfying UL requirement.
 "LEOO" and "COCKN" is the CMO's UL factory code for Ningbo factory..

Serial ID includes the information as below:

- (a) Manufactured Date: Year: 1~9, for 2001~2009
 Month: 1~9, A~C, for Jan. ~ Dec.
 Day: 1~9, A~Y, for 1st to 31st, exclude I , O and U
 (b) Revision Code: cover all the change
 (c) Serial No.: Manufacturing sequence of product

For Lenovo's barcode content

11S PPPPPP Z1Z HHH SSSSSS YMM

- (a) 11S: Fixed characters.
 (b) PPPPPP (P/N): Customer part number 42T0645, fixed characters
 (c) Z1Z: Fixed characters.
 (d) HHH (Header Code): FKV
 (e) SSSSSS: Series number.
 (f) YMM: Y: The last character of year. MM: Month

11.2 CARTON LABEL



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CHI MEI OPTOELECTRONICS

PO.NO. _____

Part ID. P/N 42T0645

Model Name N140B6-L01

Carton ID. _____ Quantities 20

Made in XXXX

www.panelook.com

12 LCD Module Inspection Specifications

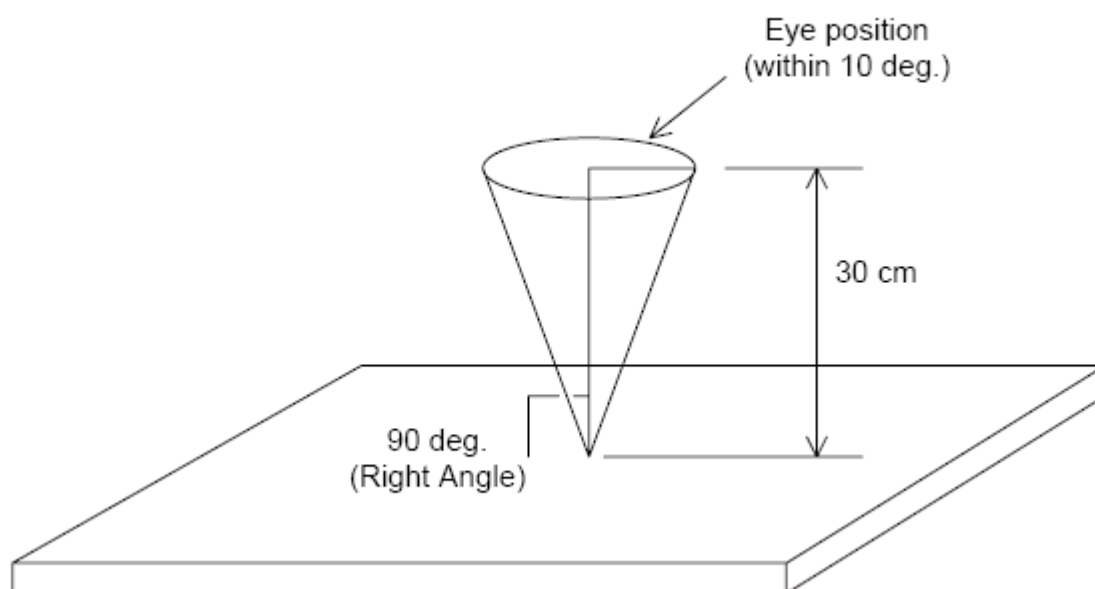
12.1 Description

These inspection standards shall be applied to LCD Module supplied by CHI MEI Optoelectronics Corporation.

12.2 The environmental condition of inspection

The environmental condition and visual inspection shall be conducted as below.

- (1) Ambient temperature : 15~25°C
- (2) Humidity: 25~75 %RH
- (3) External appearance inspection shall be conducted by using a single 20W fluorescent lamp or equivalent illumination.
- (4) Panel visual inspection on the operation condition for cosmetic shall be conducted at the distance 30cm between the LCD module and eyes of inspector.



(5) Using method for ND Filter

When using ND Filter for judging Mura, placing ND Filter near Mura defect and get close to the surface of LCD Panel (its distance shall be 1~2cm between the surface of Panel and ND Filter). Don't touch the surface of polarizer to avoid scratching polarizer, and then move to the defect position to judge mura by view angel 90 degree (The viewing angle shall be 90 degree to the right top of Mura defect with panel)

12.3 Classification of defects

Defects are classified two types, major defect and minor defect according to the defect. And, the definition of

defects is classified as below.

(1) Major defect

Any defect may result in functional failure, or reduce the usability of product for its purpose. For example, electrical failure, deformation and etc..

(2) Minor defect

A defect that is not to reduce the usability of product for its intended purpose and un-uniformity, dot defect and etc..

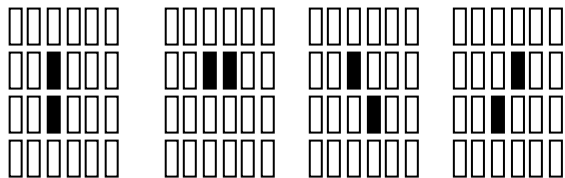
The criteria on major and/or minor judgement will be according with the classification of defects.

12.4 Inspection Criteria

(1) Definition of dot defect

Define spec for 2 dot adjacent and minimum distance

2-adjacent(Linked Pixels)



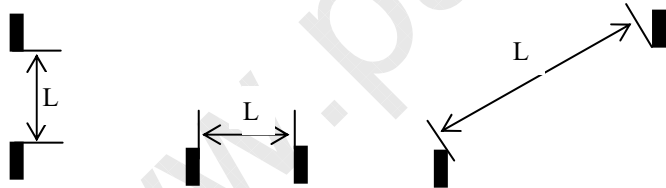
□ : sub-Pixel(R,G,B)

Minimum Distance;

Lit to Lit : $L \geq 15\text{mm}$

Unlit to Unlit : $L \geq 5\text{mm}$

Lit to Unlit : Not Applicable



L: Sub-Pixel to Sub-Pixel, Sub-Pixel to 2-adjacent or 2-adjacent to 2-adjacent

(2) Display Inspection

- a) Ambient Illumination: 250 Lux or more for light on inspection
- b) Viewing Angle: Within LCD Viewing Angle Specification
- c) Inspection Pattern (Bright dot): In black pattern

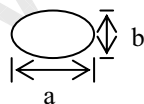
Inspection Pattern (Dark dot): In red, green, blue pattern

Items		XGA WXGA	SXGA+ WXGA+ WSXGA+	UXGA WUXGA	HD HD+ FHD
Bright dot	Random	$N \leq 2$	$N \leq 2(G=1)$	$N \leq 2(G=0)$	$N \leq 2(G=0)$
	2 dots adjacent	$N \leq 1(G=0)$	$N \leq 0$	$N \leq 0$	$N \leq 0$
	3 dots adjacent or more	$N \leq 0$	$N \leq 0$	$N \leq 0$	$N \leq 0$
Dark dot	Random	$N \leq 3$	$N \leq 5$	$N \leq 10$	$N \leq 3$
	2 dots adjacent	$N \leq 1$	$N \leq 1$	$N \leq 2$	$N \leq 1$
	3 dots adjacent or more	$N \leq 0$	$N \leq 0$	$N \leq 0$	$N \leq 0$
Distance	Lit to Lit	$L \geq 15\text{mm}$	$L \geq 15\text{mm}$	$L \geq 15\text{mm}$	$L \geq 15\text{mm}$
	Unlit to Unlit	$L \geq 5\text{mm}$	$L \geq 5\text{mm}$	$L \geq 5\text{mm}$	$L \geq 5\text{mm}$
	Lit to Unlit	Not allowable	Not allowable	Not allowable	Not allowable
Total bright and dark dot		$N \leq 5$	$N \leq 7$ (SXGA+ WXGA+) $N \leq 9$ (WSXGA+)	$N \leq 10$ (UXGA) $N \leq 12$ (WUXGA)	$N \leq 5$
Defective Dot (Lit/Unlit) : Noticeable defective dots in the office environment (250 lux) will be counted regardless of defective dot size					
Display failure (V-line/H-line/Cross line etc.)				Not allowable	
Mura	Mura defect can not show in 50% gray pattern with 8% ND-filter or judge by limit sample if necessary				

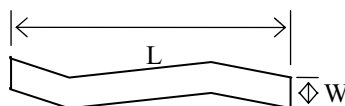
(3) Appearance inspection

- a) Ambient Illumination: 500 ~ 700 Lux
- b) Viewing Angle: Backlight-Off Condition: At Right Angle To Polarizer Surface
 Backlight-On Condition: Within LCD Viewing Angle Specification
- c) Inspection Pattern: In White and 32-Gray(Half-Gray)Screens(Backlight-On)

Items	Size(mm)	Acceptable count
1. Scratch(Line Shape) : B/L –off condition	$W < 0.05$	Ignore
	$0.05 \leq W < 0.1; 0.3 \leq L \leq 3.0$	$N \leq 4$
	$0.10 \leq W$ or $3.0 < L$	$N = 0$
	Shall be no visible at B/L on.	
2. Dent : B/L –off condition	$D < 0.2$	Ignore
	$0.2 \leq D < 0.5$	$N \leq 5$
	$0.5 \leq D$	$N = 0$
	Spacing between defects shall be more than 30 mm. ($0.2 \leq D < 0.5$) Shall be no visible at B/L on.	
3. Bubble : B/L –off condition	$D < 0.2$	Ignore
	$0.2 \leq D < 0.5$	$N \leq 5$
	$0.5 \leq D$	$N = 0$
	Shall be no visible at B/L on.	
4. Foreign material (Line-shape: stain inclusion) :B/L-on condition	$W < 0.05$	Ignore
	$0.05 \leq W < 0.10; 0.3 < L \leq 2.0$	$N \leq 4$
	$0.10 < W$ or $2.0 < L$	$N = 0$
	Shall be no visible at B/L on.	
5. Foreign material (Dot-shape: stain inclusion) :B/L-on condition	$D < 0.2$	Ignore
	$0.2 \leq D < 0.5$	$N \leq 5$
	$0.5 \leq D$	$N = 0$
6. Peeling on Polizer edge :B/L-off condition	$D < 0.2$	Ignore
	$0.2 \leq D < 0.5$	$N \leq 5$
	$0.5 \leq D$	$N = 0$
	Bubble or glue shall not be visible within PC bezel opening area with specified inspection viewing angle. Continuous peeling off on polarizer edge shall be discussed. Shall be no visible at B/L on.	



$$D = (a + b) / 2$$



W: width, L : length



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Approval

12.5 External Appearance Inspection Criteria

Item	Contents	
Screw	Parts mounting, incomplete assembly, deformation, oxidized, crooked or rusty is not permitted.	
CCFT cable	Cable not continuous 、 Break-off 、 Connector Burn-off /Break-off	
Metal frame (Bezel)	Scratch	*Noticeable scratch and exfoliation coating are not permitted. *The oxidized metal is not permitted.
	Incomplete assembly is not permitted.	
Backlight	Scratch	The scratch which may causes a problem in practical use is not permitted.
	Break-off	Breaking off is not permitted.
	Crack	The crack is not permitted.
Stain on Polarizer	The stain which can't be wiped off is not permitted.	
Tape/Label	Incorrect position, missed label is not permitted.	
Connector	Oxidized/rusty connector is not permitted.	
Outline size	Spec. out is not permitted.	



12.6 Classification of defects

Inspection Item	Criteria and Description	Defect type
Vertical line	Signal input, vertical line off or irregular V-line appears	major
Horizontal line	Signal input, horizontal line off or irregular H-line appears	major
Cross line	Pattern signal input, a correct display is not obtained	major
No display	Signal input, display is dead	major
Irregular display	Pattern signal input, a correct display is not obtained	major
Dots defect	Exceed specified standards	minor
Scratch and Dent on polarizer	Exceed specified standards	minor
Foreign material	Exceed specified standards	minor
Mura	Mura defect can not show in 50% gray pattern with 8% ND-filter or judge by limit sample if necessary	minor
External Appearance	Rust, deformation, irregular plating, coating missing etc. A appearance defect that do not affect function or performance	minor
Bezel claw	Bezel claw missing or not bent	major
Polarizer bubble	Exceed specified standards	minor
Flicker	No noticeable flicker by naked eyes at any gray scale level	major
LCD Pooling	In 50% gray pattern, hold LCD panel TOP edge (PCB side) by both hands and swing slightly back and forth 2 times per second for 3 cycles by 15 degrees (Range 30 degrees)	minor

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